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BTEC

Mark Scheme (Results)

June 2022

Pearson BTEC Nationals
In Applied Science (31617H)
Unit 1: Principles and Applications of Science I - Chemistry

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Unit 1: Principles and Applications of Science I

General marking guidance

- All learners must receive the same treatment. Examiners must mark the first learner in exactly the same way as they mark the last.
- Marking grids should be applied positively. Learners must be rewarded for what they have shown they can do, rather than be penalised for omissions.
- Examiners should mark according to the marking grid, not according to their perception of where the grade boundaries may lie.
- All marks on the marking grid should be used appropriately.
- All the marks on the marking grid are designed to be awarded. Examiners should always award full marks if deserved. Examiners should also be prepared to award zero marks, if the learner's response is not rewardable according to the marking grid.
- Where judgement is required, a marking grid will provide the principles by which marks will be awarded.
- When examiners are in doubt regarding the application of the marking grid to a learner's response, a senior examiner should be consulted.

Specific marking guidance

The marking grids have been designed to assess learner work holistically. Rows in the grids identify the assessment focus/outcome being targeted. When using a marking grid, the 'best fit' approach should be used.

- Examiners should first make a holistic judgement on which band most closely matches the learner's response and place it within that band. Learners will be placed in the band that best describes their answer.
- The mark awarded within the band will be decided based on the quality of the answer, in response to the assessment focus/outcome and will be modified according to how securely all bullet points are displayed at that band.
- Marks will be awarded towards the top or bottom of that band, depending on how they have evidenced each of the descriptor bullet points.

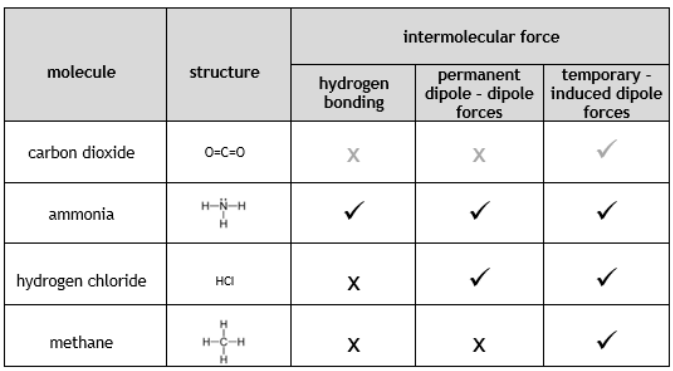
BTEC Next Generation Mark Scheme

Question Number	Answer	Additional Guidance	Mark
1 (a)(i)	jewellery / cutlery allow any other correct use	allow types of jewellery e.g ring allow types of cutlery e.g spoon allow wire allow (in) dental fillings allow coins allow ornamental objects e.g ornamental cup ignore properties whether correct or not	1
1 (a)(ii)	rubidium / caesium / francium	allow correct symbols ignore potassium	1
1 (a)(iii)	calcium has 2 electrons in its **outer** shell / sodium has one electron in its **outer** shell (1) therefore more energy needed to remove electron(s) (from calcium)/ ORA (1) OR calcium has more protons / ORA(1) greater electrostatic attraction for electrons (in outer shell) / more energy needed to remove electrons / electrons harder to remove / ORA (1)	ignore statements about atomic radius, shielding and shells allow diagrams allow calcium has more electrons in **outer** shell ORA	2

1 (b)	copper (is oxidised) (1) (copper) lost electrons / increase in oxidation state (1) silver (ions are reduced) (1) (silver ions) gain electrons / decrease in oxidation state (1)	ignore references to loss or gain of oxygen allow formula allow oxidation is loss of electrons (1) allow formula allow reduction is gain of electrons (1) allow half equations showing loss and gain of electrons	4
		Total	8 marks

Question Number	Answer	Additional Guidance	Mark
2 (a)(i)	any one from: • can have different oxidation states • can form different charged ions • (most have) high melting point • conductor of heat/electricity • form coloured compounds • can form complex ions • high boiling point • shiny / lustrous • high density • malleable • ductile • hard accept any other reasonable response	allow can be used as a catalyst ignore any reference to reactivity allow strong ignore partially complete d-sub shell ignore solid	1
2 (a)(ii)	D 		1
2 (b)	substitution (1) $\frac{1.975}{0.050}$ evaluation (1) = 39.5	39.5 gains 2 marks with or without working	2
2 (c)(i)	moles of K (1) $\frac{0.489}{39.1}$ = 0.0125(0639)		1
2 (c)(ii)	**Answer taken from (c)(i)** number of ions (1) $0.0125 \times 6.02 \times 10^{23}$ evaluation (1) 7.525×10^{21} OR **Using value 0.016** number of ions (1) $0.016 \times 6.02 \times 10^{23}$ evaluation (1) 9.632×10^{21}	7.53×10^{21} gains 2 marks with or without working ignore sig figs allow answer not in standard form allow ECF throughout	2

Total	7 marks

Question Number	Answer	Additional Guidance	Mark
3 (a)(i)	**A** ammonia		1
3 (a)(ii)	**B** carbon dioxide		1
3 (b)	(2) OR **two shared pairs** of electrons between the carbon and **each** oxygen (1) rest of molecule correct (1)	ignore inner electrons whether correct or not allow dots, crosses or a mixture of both	2
3 (c)	Award one mark for an identification point and one mark for the linked expansion point. 4 {electron pairs / hydrogen (atoms) / bonds} (around central carbon) (1) {electron pairs / bonds} repel each other (as far away from each other as possible) (1)	 allow methane is tetrahedral allow hydrogen atoms are repelled	2
3 (d)	 (3) 1 mark per column		3
		Total	9 marks

molecule	structure	intermolecular force		
		hydrogen bonding	permanent dipole - dipole forces	temporary - induced dipole forces
carbon dioxide	O=C=O	x	x	✓
ammonia		✓	✓	✓
hydrogen chloride	HCl	x	✓	✓
methane		x	x	✓

Question number	Indicative content
4	• all have high melting points • because they all contain strong electrostatic attraction between positive and negative ions • forms giant lattice structures • with many ionic bonds in different directions • bonds require a large amount of heat/ thermal energy to break • $MgCl_2$ has a lower melting point than MgF_2 • although chloride and fluoride ions have same charge • because ionic radius of chloride is bigger than fluoride • therefore attraction between positive and negative ions is weaker • therefore easier to separate the ions/lower melting point • MgF_2 has a higher melting point than NaF • sodium is in group 1 whereas magnesium is in group 2 • sodium form Na^+ ions whereas magnesium forms Mg^{2+} ions • therefore stronger attraction between Mg^{2+} ions and F^- ions than between Na^+ ions and F^- ions • therefore harder to separate the ions/higher melting point (in MgF_2) • $MgCl_2$ has a lower melting point than NaF • because although Mg^{2+} has a higher attraction to negative ions than Na^+ • ionic radius of chloride is bigger than fluoride • therefore attraction between positive and negative ions is weaker • therefore easier to separate the ions/lower melting point Accept any other valid response.

Mark scheme (award up to 6 marks) refer to the guidance on the cover of this document for how to apply levels-based mark schemes*.		
Level	**Mark**	**Descriptor**
Level 0	0	No rewardable material.
Level 1	1–2	• Demonstrates adequate knowledge of scientific facts/concepts with generalised comments made • Generic statements may be presented rather than linkages being made so that lines of reasoning are unsupported or partially supported The explanation shows some structure and coherence
Level 2	3–4	• Demonstrates good knowledge and understanding by selecting and applying some relevant scientific knowledge facts/concepts to provide the discussion being presented • Lines of argument mostly supported through the application of relevant evidence The explanation shows a structure which is mostly clear, coherent and logical
Level 3	5–6	• Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of scientific facts/concepts to provide the discussion being presented • Line(s) of argument consistently supported throughout by sustained application of relevant evidence • The explanation shows a well-developed structure which is clear, coherent and logical

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